ROTARY MACHINE FOR DELIVERING LIQUIDS OR GASES

Patent Number:	WO9427048
Publication date:	1994-11-24
Inventor(s):	FERENCZY GYOZ (HU)
Applicant(s):	DIOSGYORI SZIVATIYUGYAR KFT (HU); FERENCZY GYOZ
Requested Patent:	☐ WO9427048
Application	WO1994HU00013 19940510
Priority Number(s):	HU19930001340 19930510
IPC Classification:	F04B43/14; F04B43/12; F04B45/10
EC Classification:	F04B43/12G4, F04B43/14
Equivalents:	AU7008294, HU66329
Cited Documents:	US3684408; US4544329; DE573751; SU1208310

Abstract

The invention relates to a rotary machine for delivering liquids or gases, the invention is a rotary machine for delivering liquids or gases comprising a driving unit (2) coupled with a rotating part (11), a housing (1) provided with suction and delivery openings (5, 7) and a stationary part (3) arranged in said housing (1). The machine according to the invention may be a pump or compressor and is very advantageous among others for pumping corrosive and erodent fluids or compressing gases, wherein, according to the invention, the rotating part (11) is provided with rolls (15) rotatably mounted on shafts (16) arranged radially with respect to the axis of rotation (6) of the machine, said stationary part is an elastic disc (3) provided with channels (8) within said disc (3) and with ribs (25) on the surface facing the rolls (15) along said channels (8), wherein each of the channels are including an angle with the respective radii (R) and one end thereof is connected to the suction opening (7), the other one to the pressure opening (5). The rolls (15) are of conical shape having a greater diameter radially outside than inside and are arranged in uniform distances from each other along a circle coaxial with the axis of rotation (6). The respective heights (h) of the ribs (25) are greater than that of the channels (8) in the same axial directions. The elastic discs (3) preferably consist of two parts (3a, 3b) in axial direction: a support part (3a) at the front wall of the housing and a pressed part (3b) facing the inside of the housing (1), the channels (8) being between these two parts (3a, 3b).

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INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 5 : F04B 43/14, 43/12, 45/10 — A1

(11) International Publication Number: WO 94/27048

(43) International Publication Date: 24 November 1994 (24.11.94)

(21) International Application Number: PCT/HU94/00013

(22) International Filing Date: 10 May 1994 (10.05.94)

(30) Priority Data:
P 9301340 10 May 1993 (10.05.93) HU

(71) Applicant *(for all designated States except US)*: DIÓSGYŐRI SZIVATTYÚGYÁR KFT. [HU/HU]; Gyár út 19, H-3900 Szerencs (HU).

(72) Inventor; and

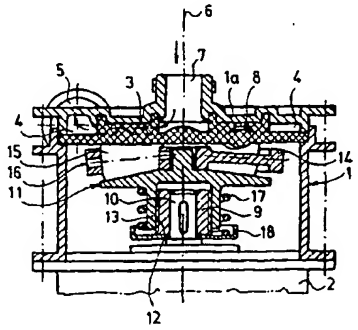
(75) Inventor/Applicant *(for US only)*: FERENCZY, Győző [HU/HU]; Kempelen Farkas u. 12/D, H-1124 Budapest (HU).

(74) Agent: DANUBIA; Bajcsy-Zsilinszky út 16, H-1051 Budapest (HU).

(81) Designated States: AU, BB, BG, BR, BY, CA, CN, CZ, FI, JP, KP, KR, KZ, LK, LV, MG, MN, MW, NO, NZ, PL, RO, RU, SD, SK, UA, US, UZ, VN, European patent (AT, BE, CH, DE, DK, ES, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, ML, MR, NE, SN, TD, TG).

Published
With international search report.
Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.

(54) Title: ROTARY MACHINE FOR DELIVERING LIQUIDS OR GASES



(57) Abstract

The invention relates to a rotary machine for delivering liquids or gases, the invention is a rotary machine for delivering liquids or gases comprising a driving unit (2) coupled with a rotating part (11), a housing (1) provided with suction and delivery openings (5, 7) and a stationary part (3) arranged in said housing (1). The machine according to the invention may be a pump or compressor and is very advantageous among others for pumping corrosive and erodent fluids or compressing gases, wherein, according to the invention, the rotating part (11) is provided with rolls (15) rotatably mounted on shafts (16) arranged radially with respect to the axis of rotation (6) of the machine, said stationary part is an elastic disc (3) provided with channels (8) within said disc (3) and with ribs (25) on the surface facing the rolls (15) along said channels (8), wherein each of the channels are including an angle with the respective radii (R) and one end thereof is connected to the suction opening (7), the other one to the pressure opening (5). The rolls (15) are of conical shape having a greater diameter radially outside than inside and are arranged in uniform distances from each other along a circle coaxial with the axis of rotation (6). The respective heights (h) of the ribs (25) are greater than that of the channels (8) in the same axial directions. The elastic discs (3) preferably consist of two parts (3a, 3b) in axial direction: a support part (3a) at the front wall of the housing and a pressed part (3b) facing the inside of the housing (1), the channels (8) being between these two parts (3a, 3b).

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ROTARY MACHINE FOR DELIVERING LIQUIDS OR GASES

The present invention relates to a rotary machine for delivering liquids or gases comprising a driving unit coupled with a rotating part, a housing provided with suction and delivery openings and a stationary part arranged in said housing.

Nowdays, turbine pumps, screw pumps, piston pumps and membrane pumps are generally used for delivering fluids.

Turbine pumps have a rather high delivery and piston pumps have rather high lift. At the same time, the turbine pumps have rather low lift and the piston pumps have rather small delivery. Accordingly, neither of these pumps has an advantageous performance characteristics for the practice.

On the other side, the membrane pumps have rather low lift as well as delivery and, at the same time have to be provided with rectification valves, and a mechanism for producing reciprocating motion which is rather disadvantageous with respect to the construction and the costs. Further disadvantage is the pulsating character of the delivery. Accordingly, membrane pumps are rarely used in the practice.

Screw pumps would be optimal for medium power and delivery requirements. This type of pumps is, however, rather complicated and expensive on the one hand, and has a rather high energy consumption, on the other hand. Furthermore, there are significant frictions within the pump, which would result in a relatively quick wearing.

It is also known a pump which comprises an elastic hose and rolls which are moving on said elastic hose in a way that closed sections within the hose deliver some fluid from one end of the hose to the other end thereof. The use of such types of pumps, however, is rather limited because of the low lift and delivery. Further disatvantage of that pump is the quick wearing of the hose which is pressed and released continuously.

Accordingly, the object of the present invention is to provide a self-priming rotary displacement machine (pump or compressor) of relatively simple construction and good performance characteristics which does not contain reciprocating parts or valves.

A further object of the invention is to minimise the friction between the elements moving with respect to each other and to avoid any planetary movement.

Accordingly the invention is a rotary machine for delivering liquids or gases comprising a driving unit coupled with a rotating part, a housing provided with suction and delivery openings and a stationary part arranged in said housing. The machine according to the invention may be a pump or compressor and is very advantageous among others for pumping corrosive and erodent fluids or compressing gases, wherein, according to the invention, the rotating part is provided with rolls rotatably mounted on shafts arranged radially with respect to the axis of rotation of the machine, said stationary part is an elastic disc provided with channels within said disc and with ribs on the surface facing the rolls along said channels, wherein each of the channels are including an angle with the respective radii and one end thereof is connected to the suction opening, the other one to the pressure opening. The rolls are of conical shape having a greater diameter radially outside than inside and are arranged in uniform distances from each other along a circle coaxial with the axis of rotation. The respecitve heights of the ribs are greater than that of the channels in the same axial directions.

The elastic discs preferably consists of two parts in axial direction: a supported part at the front wall of the housing and a pressed part facing the inside of the housing, the channels being between these two parts.

The opposite walls of the channels defined by the parts if the disc have arcuate shapes wherein the radius of the wall at the front wall is smaller than that of the other wall.

The parts of the disc are connected to each other by ribs and grooves on and in their opposite surfaces, respectively.

The parts of the disc may also be connected by inserts fitting into grooves in their opposite surfaces and having radial extensions reaching the channels by thin edges.

There may be grooves on both sides of the channels in the surface of the disc supported by the housing.

Th angle between the channels and the radii is continously changing along the channels, i.e. the channels are spiral ones.

The main point of the invention is therefore the elastic disc which is arranged between the front wall of the housing and the rolls of the rotating part, and comprises channels for delivering fluid from the suction opening to the pressure opening, due to the movement of the rolls which produces closed sections filled with fluid.

This structure and operation is not known in the field of pumps, so far. The way of operation resembles to the elastic hose pump which, however, has a low lift and delivery, meanwhile the machine according to the invention may be used for actually all purposes.

The invention is based on the recognition that an elastic disc provided with channels is rigid enough for producing rather high pressures and, at the same time, it is elastic enough to realize a delivery by producing closed sections. The rather high number of rotation enables a rather high delivery, meanwhile relatively low deformation is produced, which results in a relatively low load and long life time.

The machine is working without surface friction, which also increases the working life and reduces energie consumtion.

The rotating elemlent comprising the rolls can work separated from the fluid delivered. Accordingly, lubrication may be ideal and no stuffing box is needed. All these parameters ensure a relatively high efficiency.

A proper choice of the materials for the housing and the disc enables to use the pump according to the invention for delivering chemicals as well as corrosive fluids.

The characteristic features of the machine are really advantageous in view of the application in the practice. These advantages are as follows:

- it is a rotary-type machine
- it is a displacement machine (the delivery is actually independent from the resistance)
- it can be applied both for gases and fluids and is it self-priming
- it is rather small and compact

- it is consisting only of relatively simple parts
- there is no stuffing box in the machine
- pressure and delivery are both advantageous and, accordingly, it has an improved performance characteristic
- the fluid delivered is not in contact with the working surfaces,
- there is no friction at all
- it can be produced and operated cheaply and safely
- it has long working life and
- it is suitable for delivering corrosive materials and chemicals.

All the above mean that the machine according to the invention is suitable for meeting a rather broad range of requirements, first of all in the small and medium delivery and pressure ranges in a way which is environment saving.

Further details and advantages of the invention will be described by way of xamples and with the accompanying drawing. In the drawing

- Figure 1 is the longitudinal section of a pump according the invention,
- Figure 2 is a cross-section of the disc applied in the pump according to Fig. 1.
- Figure 3 is the radial section of a part of a disc and
- Figure 4 is the radial section of the disc according to another embodiment.

The pump according to the invention, comprises a housing 1 connected to a driving unit 2. In this housing 1 there is an elastic disc 3. Between the upper wall 1a of the housing 1 and the disc 3, there is a pressure chamber 4 which is provided with a delivery opening 5. Coaxial with the rotation axis 6, there is a suction opening 7.

Within the elastic disc 3, there are channels 8 extending from the rotation axis 6 until the pressure chamber 4. The channels 8 according to the embodiment in Figure 1 are of a spiral form as shown in Figure 2. That means that the angle α between the tangents of a channel 8 and the respective radius of the disc 3 is changing continously. Accordingly: $\alpha 2 > \alpha 1$

A carrier 9 is fixed on the shaft 10 of the driving unit 2 and the rotating part 11 of the machine is arranged between the carrier 9 and the disc 3. The rotating part 11 according to the embodiment shown in Figure 1 consists of a hub 13 and a crown 14. In The crown 14 rolls 15 are rotatably mounted on radial shafts 16. The rolls 15

are of conical shape the smaller ends facing the rotation axis 6. The outer surface of th carrier 9 and the inner wall ar provided with high pitch thread 12 and stop elements (not shown). A spiral ring 17 is arranged between the crown 14 and a support cup 18.

The structure of the elastic disc 3 is shown in Figures 2 to 4.

Disc 3 is made of two parts 3a and 3b and these two parts are connected by ribs 19 and corresponding grooves 20 according to the embodiment in Figure 3. Channels 8 are generally defined by two opposite walls 21 and 22 of arcuate shape wherein the radius R_2 of the arc at the front wall 1a of the housing is smaller than that of the opposite arc.

The connection between the two parts according to Figure 4 is produced by grooves 20a and 20b in the opposite parts and inserts 23 provided with extensions 24. Extensions 25 are arranged in a way that they reach channel 8 at the edges between the upper and lower walls 21, 22.

Elastic disc 3 is provided with ribs 25 on their surface facing the inner space of the housing 1. The height $\underline{h}$ of ribs 25 is preferably greater than the height $\underline{h_2}$ of the channels 8 in the corresponding axial direction.

The surface of the elastic disc 3 contacting the upper wall 1a of the housing 1 is preferably provided with grooves 26 at the sides of the channels 8.

The machine according to the invention operates as follows.

When driving unit 2 is started, shaft 10 rotates carrier 9, which in turn drives the part 11 of the pump. Due to the inertia of the rotating part 11, there is a slip between carrier 9 and the hub 13. Accordingly, the high pitch threads 12 move with respect to each other and force the rotating part 11 toward the elastic disc 3. In this way, rolls 15 are urged with optimum pressure to the elastic disc 3 throughout the operation. When the pump is out of operation, spring 17 exerts a slight pressure only, in order to prevent static deformation of the elastic disc 3. On the other hand, the stops on the carrier 9 and the hub 13 limit the axial motion of the rotating part 11 and, accordingly, prevents to grow too high.

Due to the rotation of the rotating part 11, rolls 15 continuously press ribs 23 in a way that they close channels 8 at certain points as it can be seen on the left side of Figure 1. In this way, closed sections are produced and moved from the suction opening 7 to the pressure port 5.

Grooves 26 on both sides of the channels 8 make easier the closing of the channels 8 and therefore stress peaks in the elastic material of the disc 3 may be avoided.

In order to show the possible delivery of the pump according to the invention, it would be supposed that a disc of 100 mm diameter provided with six channels has a useful volume of about 1 cm^3. If there are 4 rolls in the rotating part and the driving unit is rotating with a 2880 rpm, the delivery can be calculated as follows (if the efficiency coefficient is 0.8):

$Q = 0.8 \quad V \cdot z_1 \cdot z_2 \cdot n/2 = 0.8 \cdot 1 \cdot 6 \cdot 4 \cdot 1440 = 30000\ cm^3/min = 1{,}8\ m^3/h,$

which a rather good value.

The lift of the pump can be limited by applying elastic rolls.

Claims

1. Rotary machine for delivering liquids or gases, comprising a driving unit coupled with a rotating part, a housing provided with suction and delivery openings and a stationary part arranged in said housing **characterized in that** said rotating part (11) is provided with rolls (15) rotatably mounted on shafts (16) arranged radially with respect to the axis of rotation (6) of the machine, said stationary part being an elastic disc (3) provided with channels (8) within said disc (3) and ribs (25) on the surface facing the rolls (15) along said channels (8) wherein

- each of the channels (8) are including an angle (α) with the respective radii (R) and one end thereof is connected to the suction opening, the other one to the delivery opening (5),
- the rolls (15) are of conical shape having a diameter greater radially outside than inside and are arranged in uniform distances from each other along a circle coaxial with the axis of rotation (6),
- the respecitve heights (4) of the ribs (25) are greater than that of the channels (8) in the same axial directions.

2. Rotary machine as claimed in claim 1, **characterized in that** the elastic discs (3) preferably consists in axial direction of two parts: a supported part (3a) at the front wall (1a) of the housing (1) and a pressed part (3b) facing the inside of the housing (1), said channels (8) being between these two parts (3a, 3b).

3. Rotary machine as claimed in claim 2, **characterized in that** the opposite walls (21, 22) of the channels (8) defined by the parts (3a, 3b) of the disc (3) have arcuate shapes wherein radius (R_2) of the arc at the housing (1) is smaller than that R_1 of the other arc.

4. Rotary machine as claimed in claim 2 or 3, **characterized in that** the parts (3a,3b) of the disc (3) are connected to each other by ribs (19) and grooves (20) on/in their opposite surfaces.

5. Rotary machine as claimed in claim 2 or 3, **characterized in that** the parts (3a,3b) of the disc (3) are connected to each other by inserts (23) fitting into grooves (20a,20b) in their opposite surfaces and having radial extensions (24) reaching the channels (8) by thin edges.

6. Rotary machine as claimed in any of claims 1 to 5, **characterized in that** there are grooves (26) on both sides of the channels, in the surface of the disc (3) supported by the housing (1).

7. Rotary machine as claimed in any of claims 1 to 6, **characterized in that** the angle (α) between tangents of the channels (8) and the radii of the disc (3) is continously changing along the channels.

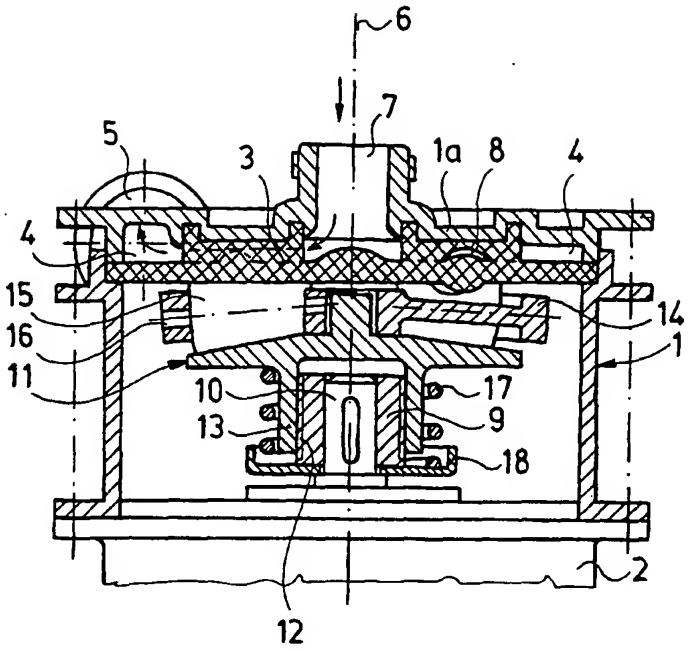

Fig. 1

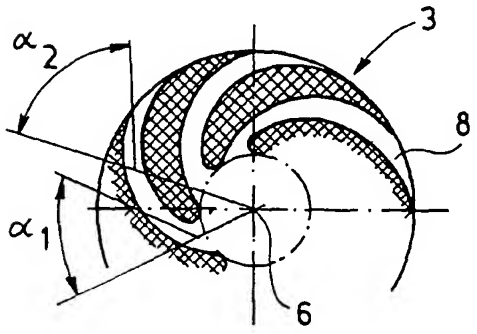

Fig. 2

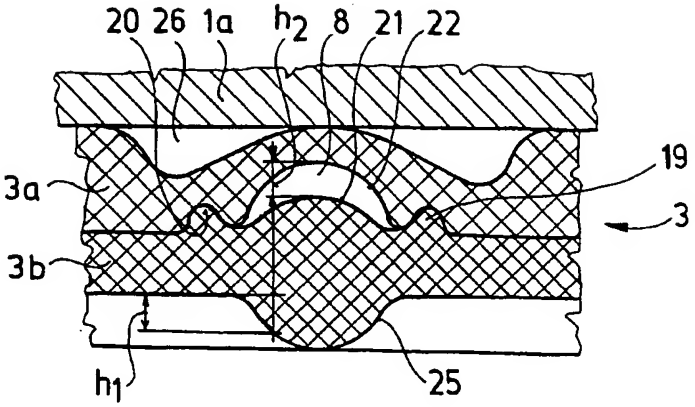
20 26 1a h2 8 21 22
19
3a
3
3b
h1
25

Fig.3

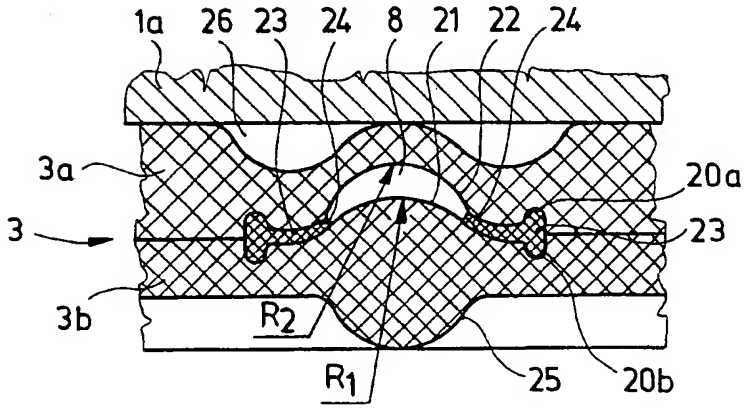
1a 26 23 24 8 21 22 24
3a
20a
3
23
3b
R2
R1
25
20b

Fig.4

INTERNATIONAL SEARCH REPORT

International application No.
PCT/HU 94/00013

A. CLASSIFICATION OF SUBJECT MATTER

IPC[5]: F 04 B 43/14, 43/12, 45/10

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC[5]: F 04 B 43/00, 43/08, 43/12, 43/14, 45/08, 45/10; F 04 C 5/00

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C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US, A, 3 684 408 (MACLIN) 15 August 1972 (15.08.72), totality; espacially figs.2,3.	1-7
A	US, A, 4 544 329 (O'BOYLE) 01 October 1985 (01.10.85), totality.	1-7
A	DE, C, 573 751 (SICCAMETER) 16 March 1933 (16.03.33), totality.	1-7
A	Soviet Inventions Illustrated, section P,Q, week 8638, 29 October 1986 (29.10.86), Derwent Publications LTD London, Q 56; SU, A, 1 208 310 (SAPUNOV).	1-7

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US A 3684408	15-08-72	keine - none - rien	
US A 4544329	01-10-85	keine - none - rien	
DE 573751		keine - none - rien	